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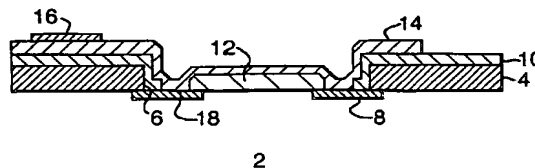
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(54) Title: PHOTODETECTOR CIRCUITS



(57) **Abstract:** A photodetector circuit incorporates an avalanche photodiode structure having a contact layer (14) forming an ohmic contact over an annular region (18) with the annular guard ring (8). In the fabrication process, the starting substrate can either be the handle wafer of a p-silicon-on-insulator wafer, or a p-Si substrate with an insulating SiO<sub>2</sub> layer (4). A window (6) is produced in the insulating layer (4) by conventional photolithographic and etching. A n<sup>+</sup> guard ring (8) is created by diffusing donor impurities into the substrate, and a thinner insulating SiO<sub>2</sub> layer (22) is thermally grown so as to cover the exposed surface of the substrate within the window (6). P-type dopant is then implanted through the thin oxide layer to increase the doping level near the surface of the substrate. Subsequently a second window (24) is made in the insulating layer (22), and the layer (12) is then epitaxially grown selectively on the area of the substrate exposed by the window (24) in the insulating layer (22). The use of the thin oxide layer (22) reduces the area of the interface between the silicon of the layer (12) and the SiO<sub>2</sub> of the layer (22) during the selective epitaxial deposition, thus leading to a reduction in the detrimental effect of the thermal expansion coefficient mismatch and producing less epitaxial defects at the window edge. After the epitaxial layer (12) has been grown the remaining part of the insulating layer (22) is removed by wet oxide etch which exposes an annular portion (26) of the underlying guard ring (8). Subsequently a n<sup>+</sup> silicon epi-poly layer (14) is deposited on the surface of the device, and forms an ohmic contact with the guard ring (8), and simultaneously forms the top contact of the photodiode. Such a fabrication process does not significantly increase the fabrication complexity. Although an additional mask is required as compared with the conventional fabrication process, the fact that the layer (14) is in ohmic contact with the guard ring (8) means that it is no longer necessary to provide a separate contact to the guard ring, and as a result the overall number of masks or process steps used may be similar in both processes.

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